*PATENT*

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

In re application of: Javier JUANARENA SARAGUETA, et al.

Serial No.: 10/563,043 Group No.: 2834

Filed: December 30, 2005 Examiner: J. Gonzalez

For: CONTROL AND PROTECTION OF A DOUBLY-FED INDUCTION GENERATOR SYSTEM

Attorney Docket No.: U 016070-3

Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Date: August 1, 2008

APPEAL BRIEF AND
PETITION FOR EXTENSION OF TIME

Appellants have received a Notice of Panel Decision from Pre-Appeal Brief Review, mailed on June 19, 2008. Appellants hereby petition to extend the time for filing this appeal brief by one (1) month, from July 19, 2008, to August 19, 2008. Please charge (A) the fee of $120.00 in payment of the extension, (B) the fee of $510.00 for filing this appeal brief under 37 C.F.R. 41.20(b)(2), and (C) any additional fee that may be due in connection with this paper, to our Deposit Account No. 12-0425.

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## (i) Real Party in Interest

The real party in interest is Gamesa Innovation & Technology, S.L. by Assignment recorded at Reel 018831, frame 0599 on January 22, 2007, said real party now having a new address:

Avenida Ciudad de la Innovacion, 9-11

31621 Sarriguren (Navarra) SPAIN.

## (ii) Related Appeals and Interferences

There are no related appeals or interferences.

## (iii) Status of Claims

Claims 1, 2, 7, 8, 12-17, 19, 21, 23, 25 and 26 are finally rejected and are the subject of this appeal.

Claims 6, 18, 20, 22 and 24 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form.

Claims 3-5 and 9-11 are canceled.

**(iv) Status of Amendments**

There were no amendments filed subsequent to the close of prosecution. All claims identified in subparagraph (iii) were considered as "pending" in the final rejection.

## (v) Summary of the Claimed Subject Matter

Independent claim 1 is directed to a control system (see, e.g., Fig. 5 of the present application) for a double-fed induction generator (DFIG) comprising a rotor (see, e.g., rotor 1 of Fig. 5) having rotor windings and a stator (see, e.g., stator 2 of Fig. 5) having stator windings connectable to a grid (see, e.g., grid 102 of Fig. 5) for electric power distribution.

The control system comprises a converter (see, e.g., converter 170 of Fig. 5 or converter 171 of Fig. 6; and the specification, at, e.g., page 12, lines 18-25), the converter comprising the following components: a rotor-inverter (see, e.g., rotor-inverter 71-73 of Fig. 5) connectable to the rotor windings of the generator, a grid-inverter (see, e.g., 74-76 of Fig. 5) connectable to the grid and/or to the stator windings, and a DC-link (see, e.g., DC-link 77 of Fig. 5) for feeding the rotor-inverter.

The converter (e.g., 170, 171) further comprises a clamping unit (see, e.g., clamping unit 190 of Fig. 5; Fig. 7; and the specification, at, e.g., page 12, lines 26 32) for protecting the converter from damage due to over-currents in the rotor windings, the clamping unit (190) being connectable over the rotor windings and arranged to be triggered from a non-operating state to an operating state following detection of an over-current in the rotor-windings (see the specification at, e.g., page 8, lines 9-13). The clamping unit comprises a clamping element (see, e.g., clamping element 290 of Fig. 7) arranged so that when the clamping unit is in its non-operating state, currents in the rotor windings cannot pass through said clamping element, and when the clamping unit is in its operating state, currents in the rotor windings can pass through said clamping element (see the specification at, e.g., page 8, lines 13-18). The clamping element comprises at least one passive voltage-dependent resistor element (see,

e.g., 291, 292, 293, 294 of Fig. 7) for providing a clamping voltage over the rotor windings (see the specification from, e.g., page 8, line 17 to page 10, line 1).

Claims 12, 25, and 26 are directed to a double-fed induction generator using the control system of claim 1 when connected in a specified way.

Claims 2 and 21 are directed to an embodiment wherein the clamping unit comprises multiple passive voltage-dependent resistors arranged in parallel as shown in Fig 7.

Claims 7 and 19 are directed to an embodiment wherein the clamping unit further comprises a resistor (298) coupled in parallel with the clamping element (290).

Claims 8 and 23 are directed to an embodiment wherein the clamping unit is arranged to be triggered from the non-operating state to the operating state when the voltage over the DC-link or the rotor windings rises above a pre-determined level, or when the current in the rotor-windings or the stator-windings rise a pre-determined level.

Claims 6 and 18, and claims dependent on claim 18 (i.e., claims 20, 22, and 24) are directed to control systems of claims 1 or 2, wherein a clamping system as described, for example, at page 10, lines 15-21 of the present application is employed. As noted above, such claims have been indicated to be allowable if rewritten in independent form. The clamping unit of these claims employs, in addition to at least one passive voltage-dependent resistor element, a connector, for each phase of the rotor, for connection to the respective rotor phase,

each connector being connected to a trigger branch comprising, in series: a point of connection of the clamping unit, to the connector for connection to the respective rotor phase; a thyristor for triggering the clamping unit; the clamping element; a diode; and the point of connection to the connector for connection to the respective rotor phase.

Claims 13 - 17 are directed to a method for protecting the converter in a power generation system by triggering the clamping unit from its non-operating state to its operating state when an over-current is detected in the rotor windings.

Independent Claim 13 in particular is directed to a method for protecting the converter in a power generation system (see, e.g., Fig. 5 of the present application) comprising a double-fed induction generator (DFIG) comprising a rotor (see, e.g., rotor 1 of Fig. 5) having rotor windings, a stator (see, e.g., stator 2 of Fig. 5) having stator windings connected to a grid (see, e.g., grid 102 of Fig. 5) for electric power distribution, and a control system comprising a converter (see, e.g., converter 170 of Fig. 5 or converter 171 of Fig. 6; and the specification at, e.g., page 12, lines 18-25). The converter comprises a rotor-inverter (see, e.g., rotor-inverter 71-73 of Fig. 5) connected to the rotor windings of the generator, a grid-inverter (see, e.g., grid-inverter 74-76 of Fig. 5) connected to the grid and/or to the stator windings, and a DC-link (see, e.g., DC-link 77 of Fig. 5) for feeding the rotor-inverter.

The method comprises the step of connecting a clamping unit (see, e.g., clamping unit 190 of Fig 5; Fig. 7; and the specification, at, e.g., page 12, lines 26-32) having a clamping element over the rotor windings, the clamping unit comprising a clamping element (see, e.g., clamping element 290 of Fig. 7) arranged so that when the clamping unit is in a non-operating

state, currents in the rotor windings cannot pass through the clamping element, and when the clamping unit is in an operating state, currents in the rotor windings can pass through the clamping element (see the specification at, e.g., page 8, lines 13-18). The clamping element comprises at least one passive voltage-dependent resistor element (see, e.g., 291, 292, 293, 294 of Fig. 7) for providing a clamping voltage over the rotor windings (see, the specification from, e.g., page 8, line 17 to page 10, line 1).

The method also comprises the step of triggering the clamping unit from its non-operating state to its operating state when an over-current is detected in the rotor windings (see the specification at, e.g., page 8, lines 9-13).

## (vi) Grounds of Rejection to be Reviewed on Appeal

1. Whether claims 1, 2, 7, 8, 12-17, 19, 21, 23, 25 and 26 are unpatentable under 35 U.S.C. 103(a) over U.S. Patent Application Publication US 2005/0116476 to Feddersen (hereinafter "Feddersen '476") in view of U.S. Patent No. 7,015,595 to Feddersen et al. (hereinafter "Feddersen '595").

**(vii) Argument**

1. Rejection of claims 1, 2, 7, 8, 12-17, 19, 21, 23, 25, and 26 under 35 USC 103(a) as being unpatentable over U.S. Patent Application Publication No. US 2005/0116476 A1 to Feddersen ("Feddersen '476") in view of U.S. Patent No. 7,015,595 to Feddersen et al. ("Feddersen '595")

A. Claims 1, 12, and 13

Claim 1 is directed to a control system that is of particular use in controlling double-fed induction generators, particularly those used in generation of electric energy from wind power.

As explained in more detail in the present application, when generating electric energy from wind power, wind velocity may vary and so turbine speed may vary (see, e.g., page 1, lines 11-20 of the present application). In order to maintain a constant frequency in output power to an electric grid despite variation in turbine speed, double-fed induction generators have been used. Such generators have rotor windings and stator windings connectable to an electric power grid.

There is, however, a difficulty if short circuits occur in the grid, and typically this has required disconnection of the generator from the grid to avoid other problems. As described, for example on page 4 of the present application, in order to protect the converter from overloads, it is known to provide the converter with a so-called "crowbar," arranged to short-circuit the current in the rotor windings when necessary. However, disconnection of the generator from the grid, which is necessitated by use of the crowbar, has become more problematic, for example with regard to the overall supply of power to the grid, as wind-power generation becomes more of a portion of the total electric power generation (see, e.g.,

page 6, line 25, to page 7, line 16 of the present application).

The present invention provides a control system that can protect the generator without the need for full disconnection from the grid, using a "clamping element" as recited in claim 1. As explained, for example at page 7, lines 29-33 of the present application, the problem addressed by the present invention is to effect clamping without the need to disconnect the stator of the generator from the grid in the case of a short circuit in the grid.

According to the system of claim 1, a clamping unit is included for protecting the converter from damage due to over-currents in the rotor windings, the clamping unit being connectable over the rotor windings and arranged to be triggered from a non-operating state to an operating state following detection of an over-current in the rotor-windings. The clamping unit comprises a clamping element arranged so that when the clamping unit is in its non-operating state, currents in the rotor windings cannot pass through the clamping element, and when the clamping unit is in its operating state, currents in the rotor windings can pass through the clamping element.

Notably, the clamping unit of claim 1 includes a clamping element that comprises at least one passive voltage-dependent resistor element for providing a clamping voltage over the rotor windings. An example of the clamping element is shown generically as 290 in, e.g., Fig. 5 of the present application. In the option in which multiple such passive voltage-dependent resistor elements are used, they are shown in Fig. 7 of the present application as 291, 292, 293, and 294. (See also page 8, lines 17-18 of the present application, for example.)

By virtue of the features of claim 1, the converter can start to operate again by bringing the clamping element back into its non-operating state (whereby rotor currents are

commutated to the rotor-inverter again), so that the converter can take over control of the generator again as soon as possible (see, e.g., page 8, lines 29-33 of the present application). Accordingly, the need to disconnect the generator from the grid and then reconnect the generator to the grid can be avoided, along with consequent down time, as had been required previously. As explained, for example, at page 6, lines 32-35 of the present application, avoidance of down time on wind-powered electrical generators is becoming more important as reliance on this type of power increases.

Feddersen '476, as understood by Appellants, relates to a circuit to be used in a wind power plant, comprising a double fed asynchronous generator, a crowbar, an "additional resistor" R15 (see Figs. 1 and 3, for example), and a converter. (See, e.g., the abstract of Feddersen '476.)

Feddersen '595, as understood by Appellants, relates to a variable speed wind turbine having a passive grid side rectifier using "scalar power control" which, according to that patent, provides more precise control of electrical quantities on the power grid. (See, e.g., page 1, lines 8-11 of the patent.)

It is submitted that nothing has been found, or pointed out, in Feddersen '476 or Feddersen '595, whether considered separately or in any permissible combination (if any) that would teach or suggest a clamping unit including a clamping element that comprises at least one passive voltage-dependent resistor element for providing a clamping voltage over the rotor windings, as recited in claim 1.

Feddersen '476 intends to protect the converter in the event of a short-circuit in the grid by using a crowbar or by using a controllable load resistor (see, e.g., paragraph 0007). However, a crowbar is the precise means described in the present application as prior art and,

as described in the present application, effects a disconnection from the grid and delays bringing the generator back on stream when the current overload caused by the short circuit is passed. With regard to the controllable load resistor of Feddersen '476, the controllable load resistor is merely a linear resistor and is not voltage-dependent; in short, it is simply not a passive voltage-dependent resistor element, as recited in claim 1. Indeed, if such a load resistor is used, Feddersen '476 states that it is "controlled by a switch which, in particular, can be actively switched off and is, in particular, not a naturally commutated thyristor" (see paragraph 0007). Therefore, in Feddersen '476, the voltage control is made by the actuation of the switch on the external resistor. However, in the system of claim 1, in stark contrast, the voltage is fixed indirectly by the connection -- not the active control -- of the at least one passive voltage-dependent resistor element.

MPEP 2141.02V1 provides that the prior art must be considered in its entirety, including disclosures that teach away from the claims. Emphasis on the need and desire, in Feddersen '476, for a controlled or controllable resistor can also be found in, e.g., paragraphs 0018, 0019, and 0027 of that publication. The special advantages of using at least one passive voltage-dependent resistor element as in the system of claim 1 include the following, as described on page 9 of the present application:

> It is thus important that the clamping element be a voltage-dependent resistor element, so that the voltage will not be a purely linear function of the rotor currents: the use of a normal resistor would imply that the clamping voltage would be (substantially) directly proportional to the rotor currents at each moment. Were a resistor chosen, care would have to be taken so as to choose a resistance value low enough to make sure that the clamping voltage would never exceed a maximum level allowed for the rotor-voltage, not even if the current flowing through the resistor would reach the highest level of rotor-current that could be expected. However, such a low value of the resistance might give rise to a too low level of the clamping voltage if the actual rotor-currents produced due to a short-circuit in the grid

> would be of a level much lower than said highest level that could be expected. In such a case, with a too low clamping voltage, the rotor-currents would not decrease rapidly enough so as to allow the converter to take over the control again, or at least not in order to take over the control as rapidly as one might desire. The use of a low resistance resistor would cause a high steady-state over-current in the rotor windings, at rated rotor-voltage.
>
> However, using a voltage-dependent resistor element, it is possible to choose this element so as to provide a rather well-defined clamping voltage, within a rather short range, for a large range of possible rotor-currents. Actually, there are elements that can provide for a substantially constant clamping voltage for any value of the level of the rotor-current, within a very large range, basically including the full range of possible rotor-current levels that could be expected to occur due to a short-circuit in the grid.
>
> Using a passive voltage-dependent resistor element is especially advantageous, as it provides for a rather well-defined clamping voltage without requiring any complex control of the clamping unit. Basically, it is enough to trigger the clamping unit so as to allow the rotor-currents to pass through the clamping unit instead of through the rotor-inverter. For triggering the clamping unit, a simple trigger element such as a power thyristor can be used, which can be arranged in series with the clamping element(s) and the respective rotor winding and be triggered from the control module using a very low current (for example, below 1 A, applied through a simple pulse-transformer). The clamping of the voltage over the rotor-windings is achieved by the voltage-dependent resistor element itself, and no further control is needed. That is, no "active" control of this clamping voltage is needed; once the stator-current is below its rated value, the control module can simply stop the triggering of the thyristors and, thus, stop the rotor-currents from flowing through the clamping unit after the next zero-crossing of the current through the thyristor.

Accordingly, a notable feature of the system of claim 1 is use of a different and advantageous unit for cutting off current to the converter to protect the converter in the event of a short circuit in the grid.

In the final Office Action dated August 6, 2007, the Examiner points to the resistor element (R15) of Feddersen '476, and states:

> Applicants arguments filed on 07/11/07 have been fully considered but are not persuasive. The remarks argued that the prior art fails to

> disclose a "passive voltage-dependent resistor. Feddersen ['476] discloses a resistor element, which is controlled, which can make it, passive. What makes a passive resistor? How is it determined that the resistor in the prior art is not passive? Respectfully, the <u>claims</u> are not specific enough to ***define/describe*** what makes a resistor passive? The claims only disclose using a passive resistor. (Emphasis in the original.)

First, the Examiner's closing statement in the above-cited portion of his remarks, i.e., that the claims only disclose using a "passive resistor," is simply incorrect. As noted above, claim 1 specifically recites, *inter alia*, "said clamping element comprising at least one passive <u>voltage-dependent</u> resistor element (291, 292, 293, 294) for providing a clamping voltage over the rotor windings." MPEP 2143.03 provides that "All words in a claim must be considered in judging the patentability of that claim against the prior art." MPEP § 2143.03 (quoting *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970)).

As to the Examiner's question, "What makes a passive resistor?", it is thus noted that a "passive resistor" is not claimed, and that, instead, claim 1 recites at least one "passive voltage-dependent resistor element." As explained at page 9, line 2 of the present specification, such element is voltage-dependent "so that the voltage will not be a purely linear function." The present specification describes several passive voltage-dependent resistor elements, at page 10, lines 6-14. The Examiner gives no reason to doubt Appellants' assertion that the term is understood and differs from the types of resistors used in Feddersen '476. Feddersen '476 merely uses a linear resistor in its clamping circuit, which is not voltage-dependent, and this linear resistor is actively controlled, as explained above. In the Advisory Action dated November 13, 2007, the Examiner states that "The claim needs to be more specific and clear with respect to the functionality of the passive voltage dependent resistor." However, it is submitted that since this is a term of art, it needs no further

definition in the claims.

In the final Office Action, the Examiner stated that Feddersen '476 "does not disclose explicitly having an over voltage protection/detection device." The Examiner pointed to "over voltage protector 160" of Feddersen '595, citing Fig. 1 of that patent.

However, even if Feddersen '476 and Feddersen '595 were combined, Feddersen '595 still does not teach or suggest a passive voltage-dependent resistor element, as recited in claim 1. Instead, Feddersen '595 discusses a scalar power control in column 9 and Fig. 3 that, whatever it is, is not the passive voltage-dependent resistor element of claim 1. No details of the over-voltage protection circuit 160 of Feddersen '595 apart from its location are given (see Fig. 1 of that patent). It is not a passive voltage-dependent resistor, as recited in claim 1, for the special advantage thereof as rationally underpinned only by applicant's specification, page 9, line 23, as noted above. Therefore, the system of claim 1 is different and nonobvious because:

> ...[Rejections] on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. MPEP 2141.III, quoting *KSR International Co. v. Teleflex Inc.*, 550 U.S. ___, 82 USPQ2d 1385, 1396 (2007).

The final Office Action attempts this by noting the resistor in Feddersen '476 "... which can make it passive," but then, as noted above, asks, "What makes a passive resistor?" However, it is submitted that, far from being articulated reasoning with some rational underpinning as required by *KSR*, both representations are irrational, at least, and irrelevant, because claim 1 is to passive voltage-dependence. Moreover, as noted above, the final Office Action states that "the claims only disclose using a passive resistor." This, too, is irrational, because incorrect: claim 1 requires a "passive voltage-dependent resistor," and this in

combination with the rest of the structure claimed. MPEP 2142 provides, with respect to establishing a *prima facie* case of obviousness, that "[t]he key to supporting any rejection under rejection under 35 U.S.C. 103 is the clear articulation of the reason why the claimed invention would have been obvious."

Neither Feddersen '476 or Feddersen '595 make any mention of the use of a passive voltage-dependent resistor element. As noted above, Feddersen '476 uses a conventional crowbar or a controllable (i.e., actively controlled) resistor. Fedderson '595 uses an over-voltage protection circuit 160 for which no details are given, certainly not any description of a passive voltage-dependent resistor element. Combining these references therefore can in no way lead to Appellants' invention as set out in independent claim 1. There is no mention anywhere in either reference of the above-described notable feature of Appellants' claims. Furthermore, there is no other reason why a person having ordinary skill in the art would, without the benefit of hindsight after a reading of Appellants' invention, have had any reason to utilize a passive voltage-dependent resistor element. (MPEP 2142: "...impermissible hindsight must be avoided...") There is no reason why a person having ordinary skill in the art would have adopted Appellants' solution to the problem.

Nothing in Feddersen '476 or Feddersen '595, whether considered separately or in any permissible combination (if any), would teach or suggest a control system including a clamping unit having a clamping element that comprises at least one passive voltage-dependent resistor element for providing a clamping voltage over the rotor windings, as recited in claim 1.

Accordingly, claim 1 is seen to be clearly allowable over Feddersen '476 or Feddersen '595, whether considered separately or in any permissible combination (if any).

Claims 12 and 13 recites certain features that are similar in many relevant respects to those discussed above in connection with claim 1, and therefore are believed to be patentable over the cited references for at least the same reasons. It is noted that all of the dependent claims do not stand and fall together.

B. Claims 2, 21, and 25

Having regard apparently to claims 2, 21, and 25, the Examiner makes the cryptic remark that Feddersen '476 discloses "that the resistance element can be connected in parallel," referring to paragraph 0008 of that reference. It is respectfully pointed out that paragraph 0008 does not say this. The only use of the word "parallel" in that paragraph is in pointing out that the modification discussed in the paragraph permits sharing between switches. The modification is use of "two or more resistors" which can be connected dependent on one another or independently of one another. This is not a teaching to use multiple passive voltage-dependent resistor elements in parallel in the clamping element.

C. Claims 7 and 19

So far as claims Claim 7 and 19 are concerned, although Feddersen '476 may show a resistance R15 in parallel with the crowbar, there is not the slightest suggestion in this reference that such a resistor should be a passive voltage-dependent resistor as required by the present claims.

D. Claims 6, 18, 20, 22, and 24

The Examiner accepts the patentability of claims 6 and 18 (and, therefore, dependent

claims 20, 22, and 24), which define a preferred arrangement of the clamping element and the remaining issues are the patentability of claims wherein the clamping element is defined broadly as "comprising at least one passive voltage dependent resistor element" (claims 1, 12, and 13), claims wherein it is required that a number of such passive voltage-dependent resistor elements are used in parallel (e.g., claim 2), and a resistor coupled in parallel with the clamping element (e.g., claims 7 and 19).

2. Conclusion

For the above reasons, Appellants respectfully submit that all rejections of record should be reversed.

Respectfully submitted,

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## (viii) Claims Appendix

1. A control system for a double-fed induction generator (DFIG) comprising a rotor (1) having rotor windings and a stator (2) having stator windings connectable to a grid for electric power distribution;

said control system comprising a converter (170, 171), said converter comprising the following components:

a rotor-inverter (71-73) connectable to the rotor windings of the generator,

a grid-inverter (74-76) connectable to the grid and/or to the stator windings, and

a DC-link (77) for feeding the rotor-inverter;

the converter (170, 171) further comprising a clamping unit (190) for protecting the converter from damage due to over-currents in the rotor windings, said clamping unit (190) being connectable over the rotor windings and arranged to be triggered from a non-operating state to an operating state following detection of an over-current in the rotor-windings, said clamping unit comprising a clamping element (290) arranged so that

when the clamping unit is in its non-operating state, currents in the rotor windings cannot pass through said clamping element, and

when the clamping unit is in its operating state, currents in the rotor windings can pass through said clamping element,

said clamping element comprising at least one passive voltage-dependent resistor element (291, 292, 293, 294) for providing a clamping voltage over the rotor windings.

2. A control system according to claim 1, wherein the clamping element (290) comprises a

plurality of passive voltage-dependent resistor elements (291, 292, 293, 294), arranged in parallel with at least one varistor, one zener diode or one suppression diode.

6. A control system according to claim 1, wherein the clamping unit comprises, for each phase of the rotor, a connector (300) for connection to the respective rotor phase, each connector being connected to a trigger branch comprising, in series: a point of connection (297) of the clamping unit, to the connector (300) for connection to the respective rotor phase; a thyristor (295) for triggering the clamping unit; the clamping element (290); a diode (296); and the point of connection (297) to the connector (300) for connection to the respective rotor phase.

7. A control system according to claim 1, wherein the clamping unit further comprises a resistor (298) coupled in parallel with the clamping element (290).

8. A control system according to claim 1, wherein the clamping unit is arranged to be triggered from the non-operating state to the operating state when the voltage over the DC-link or the rotor windings rises above a pre-determined level, or when the current in the rotor-windings or the stator-windings rise a pre-determined level.

12. A double-fed induction generator (DFIG) system comprising a rotor (1) having rotor windings and a stator (2) having stator windings connectable to a grid for electric power distribution, said double-fed induction generator system further comprising a control system according to claims 1, wherein the

rotor inverter (71-73) is connected to the rotor windings of the generator,

the grid inverter (74-76) is connected to the grid, and

the clamping unit (190) is connected over the rotor windings.

13. A method for protecting the converter in a power generation system comprising a double-fed induction generator (DFIG) comprising a rotor (1) having rotor windings, a stator (2) having stator windings connected to a grid for electric power distribution and a control system comprising a converter (170, 171), said converter comprising a rotor-inverter (71-73) connected to the rotor windings of the generator, a grid-inverter (74-76) connected to the grid and/or to the stator windings, and a DC-link (77) for feeding the rotor-inverter;

whereby the method comprises the steps of:

connecting a clamping unit (190) having a clamping element over the rotor windings, said clamping unit comprising a clamping element (290) arranged so that when the clamping unit is in a non-operating state, currents in the rotor windings cannot pass through said clamping element, and when the clamping unit is in an operating state, currents in the rotor windings can pass through said clamping element, said clamping element comprising at least one passive voltage-dependent resistor element (291, 292, 293, 294) for providing a clamping voltage over the rotor windings; and

triggering the clamping unit from its non-operating state to its operating state when an over-current is detected in the rotor windings.

14. A method according to claim 13, wherein the clamping unit is triggered from the non-operating state to the operating state when the voltage over the DC-link rises above a pre-

determined level.

15. A method according to claim 13, wherein the clamping unit is triggered from the non-operating state to the operating state when the voltage over the rotor-windings rises above a pre-determined level.

16. A method according to claim 13, wherein the clamping unit is triggered from the non-operating state to the operating state when the currents in the rotor-windings rise above a pre-determined level.

17. A method according to claim 13, wherein the clamping unit is triggered from the non-operating state to the operating state when the currents in the stator-windings rise above a pre-determined level.

18. A control system according to claim 2, wherein the clamping unit comprises, for each phase of the rotor, a connector (300) for connection to the respective rotor phase, each connector being connected to a trigger branch comprising, in series: a point of connection (297) of the clamping unit, to the connector (300) for connection to the respective rotor phase; a thyristor (295) for triggering the clamping unit; the clamping element (290); a diode (296); and the point of connection (297) to the connector (300) for connection to the respective rotor phase.

19. A control system according to claim 2, wherein the clamping unit further comprises a

resistor (298) coupled in parallel with the clamping element (290).

20. A control system according to claim 18, wherein the clamping unit further comprises a resistor (298) coupled in parallel with the clamping element (290).

21. A control system according to claim 2, wherein the clamping unit is arranged to be triggered from the non-operating state to the operating state when the voltage over the DC-link or the rotor windings rises above a pre-determined level, or when the current in the rotor-windings or the stator-windings rise a pre-determined level.

22. A control system according to claim 18, wherein the clamping unit is arranged to be triggered from the non-operating state to the operating state when the voltage over the DC-link or the rotor windings rises above a pre-determined level, or when the current in the rotor-windings or the stator-windings rise a pre-determined level.

23. A control system according to claim 19, wherein the clamping unit is arranged to be triggered from the non-operating state to the operating state when the voltage over the DC-link or the rotor windings rises above a pre-determined level, or when the current in the rotor-windings or the stator-windings rise a pre-determined level.

24. A control system according to claim 20, wherein the clamping unit is arranged to be triggered from the non-operating state to the operating state when the voltage over the DC-link or the rotor windings rises above a pre-determined level, or when the current in the rotor-

windings or the stator-windings rise a pre-determined level.

25. A double-fed induction generator (DFIG) system comprising a rotor (1) having rotor windings and a stator (2) having stator windings connectable to a grid for electric power distribution, said double-fed induction generator system further comprising a control system according to claim 2, wherein the

rotor inverter (71-73) is connected to the rotor windings of the generator,

the grid inverter (74-76) is connected to the grid, and

the clamping unit (190) is connected over the rotor windings.

26. A double-fed induction generator (DFIG) system comprising a rotor (1) having rotor windings and a stator (2) having stator windings connectable to a grid for electric power distribution, said double-fed induction generator system further comprising a control system according to claim 23, wherein the

rotor inverter (71-73) is connected to the rotor windings of the generator,

the grid inverter (74-76) is connected to the grid, and

the clamping unit (190) is connected over the rotor windings.

**(ix) Evidence Appendix**

None.

## (x) Related Proceedings Appendix

There are no related proceedings.